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UNCLASSIFIED INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION -1960

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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM --

SOVIET-BLOC ACTIVITIES

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I. GENERAL

A Review of the Accomplishments of the IGY -- from the Journal "Priroda"

With the ending of the year 1959 came the end of the observations made in accordance with the program of the International Geophysical Year; this has been a glorious page in the history of science in which the scientists of sixty-five countries have for the first time joined forces to investigate our planet as a whole. The attack on the secrets of nature was conducted by Soviet scientists in closed ranks with their colleagues in all countries; it can be stated with pride that Soviet science occupied one of the leading places during the time of the IGY.

The event of overwhelming importance during the International Geophysical Year was the launching in the USSR of the world's first artificial earth satellite and the subsequent launching of new satellites which made it possible to conduct experiments of a type about which geophysicists could only dream in the past.

The most distant corners of our planet were investigated during the IGY by our meteorologists and geomagnetists, astronomers and ionospheric investigators, gravimetrists and glaciologists, oceanographers and seismologists and aurora and cosmic ray researchers. Due to their everyday work, their determination, and their occasional heroism, science now has at its disposal an invaluable collection of facts about the life of the Earth. These materials now make it possible to draw some conclusions, however preliminary they may be.

The Great Successes of Meteorological Research

Great successes were achieved during the IGY in the field of meteorology. For the first time maps were compiled which show temperature and the movement of air masses at heights of 15 to 30 km for the entire Northern Hemisphere. Use of such maps has resulted in the discovery of constant winds of great intensity. Such winds, called jet streams, attain velocities of 200 and even 300 km per hour at a height of 30 km.

Need we say here how important this is for modern aviation? Even now /by/ taking advantage of the jet stream aircraft can save much fuel and time on distant flights.

Antarctica constituted an immense field of activity for meteorologists. Before the IGY it was /believed/ that the "cold pole" was situated in the Northern Hemisphere. In 1957 it "migrated" to a station established by the United States at the South Pole. But this temperature was surpassed on many occasions in the following year at Soviet Antarctic stations. Finally, on 25 August 1958 the absolute temperature minimum on our planet -87.4° C., was recorded at the station Vostok.

For the first time in history rockets were launched from the decks of the expeditionary vessel "Ob'" on the coast of Antarctica; these brought us extremely important information about processes taking place in the atmosphere over the polar regions.

Meteorological research in the tropical zone was also very promising. Interesting data were collected by Polish scientists working in the territory of the Democratic Republic of Vietnam; there they organized an aerological and meteorological station and made heliographic and actinometric measurements. A considerable stride forward was made by the use of rapid computers for the operational short-range prediction of weather. This method unquestionably offers great hopes for the future.

Radiation Belts and Magnetic Anomalies

The attainments in the field of the geomagnetic disciplines in the period of the IGY /were/ truly revolutionary. Soviet and American scientists demonstrated the existence of radiation belts surrounding our planet. One of them, the outer belt, consists primarily of electrons; its field of maximum intensity is situated at a distance of 20 to 25 thousand km from the earth. At this same distance Soviet scientists have discovered a powerful electrical current. The maximum intensity of the inner belt is situated approximately at a distance of 1.5-2 thousand km. It consists essentially of protons. Both belts constitute singular "traps" in which charged particles move at an immense velocity.

Several decades have passed since the American schooner "Carnegie" was lost; since that time there had been no special vessel in the world adapted for magnetic observations at sea. It was only during the IGY that our unique nonmagnetic ship "Zarya" made voyages into the Baltic, Mediterranean, the Atlantic and the Indian Oceans. As a result it was discovered that the position of the magnetic equator differed considerably from that which is shown on existing maps. Several previously unknown magnetic anomalies were discovered.

In accordance with the program of the IGY American scientists launched rockets from balloons for the study of the intensity of the magnetic field. In so doing they discovered previously unknown electrical currents in the ionosphere in the vicinity of the magnetic equator at a height between 90 and 130 km.

For the first time auroral observations were made in accordance with an integrated program and on an extensive basis; these observations in both hemispheres showed that the intense auroras of the Arctic were often accompanied simultaneously by a great intensification of their activity in the Antarctic.

All these discoveries shed new light on the structure and "behavior" of that immense magnet, our Earth.

Cosmic Rays - Ionosphere - Sun

Cosmic rays, coming to us from incredible distances, are the cause of many physical phenomena noted on the Earth. It has been noted that during the course of the year there is a repeated thousand-fold increase in the intensity of cosmic radiation. The determination of the nature of these "jumps" and the development of means for protection against this radiation

that is so dangerous for life is a problem of considerable importance in a day when humanity is standing on the threshold of space.

It is difficult to name any branch of technology in which the radio is not used. It is therefore understandable how important is extensive research in the ionosphere, the upper regions of the atmosphere, which exercise such an influence on the propagation of radio waves. In the period of the IGY scientists have received an unprecedented amount of data about changes in electron density with height, including data about ionized strata of the atmosphere at distances of tens of thousands of kilometers from the Earth's surface. This helps us to establish radio communications with today's "lunniks" and tomorrow's spaceships.

Many physical phenomena taking place on the Earth can be explained by those processes which transpire on the Sun. The study of these phenomena in turn can help to clarify the problem, important in nuclear physics, as to what is the behavior of the highly rarefied ionized gas in the magnetic field. This is of interest for investigations in the field of controlled thermonuclear reactions. That is the reason why the Sun was put under constant observation by the scientists of many countries during the period of the International Geophysical Year. Dozens of observatories engaged in what resembled a relay-race, "passing" the Sun from one station to another as it sank below the horizon in one part of the world and rose above the horizon elsewhere. Reports on flares and sunspots were received at a Worldwide Prognostic Center. After receiving a report from the center the specialists in geomagnetism, ionospheric research, and cosmic ray and aurora investigation immediately undertook more intensive observations.

The data from all such observations represent a broad base for continuing research activity by the representatives of the various geophysical disciplines, the more so because these data relate to a period of maximum solar activity -- a phenomenon recurring approximately every eleven years.

The "Permanent" Ice Cover of the Earth

Glaciological research was [conducted] on a broad scale during the course of the IGY. The total volume of the "permanent' ice on our planet, as shown by a "census" conducted at that time, was 22 million cubic kilometers. Included in the observations were all glaciers of any importance at all. During this period Soviet glaciologists discovered the previously unknown Kodarskiy region of glaciation in the Trans-Baykal area on the borders of the Chita and Irkutsk oblasts. Glaciological work was accomplished on an unprecedented scale on the world's largest ice sheet, Antarctica, and in Greenland, the largest ice region in our hemisphere. Expeditions were undertaken to the Fedchenko Glacier in the Pamirs (which supplies water to the rivers of Central Asia), and in the Polar Urals and Novaya Zemlya.

Ice-covered regions of Canada, Alaska, the Alps, and the mountains of India, Africa and South America were subjected to careful investigation.

As a result of this investigation of these extraordinary "iceboxes" of the /world/ more was achieved than a determination of the total amount of ice; as a result of the IGY it has finally become clear that there is a general tendency for glaciers to retreat. Consequently we should not expect a new period of glaciation in the near future.

Study of the World Ocean

More than 70% of the Earth's surface is covered by the waters of oceans, seas, lakes and rivers. It must be admitted that we still do not know a great deal about their life. In the past the efforts of the oceanographers of the various countries were disconnected, their expeditions were undertaken without a unified plan and it was impossible because of our fragmentary data to form a real idea of the nature of the world ocean.

The IGY was the first successful attempt to conduct coordinated research over the entire world ocean. Of approximately seventy ships of various countries participating in this work, twelve belonged to the Soviet Union. Our vessels, including such large and well-equipped vessels as the "Vityaz'", "Sevastopol'", Lomonosov", and "Ob'", took part in the study of all the oceans. During this period the expeditionary vessels of the USSR travelled more than 270,000 miles and /made observations/ at 2,500 stations. During the course of an expedition aboard the "Vityaz'" Soviet oceanologists discovered one of the deepest depressions in the ocean in the vicinity of the Mariana Islands (11,035 m). More than a few new submarine ranges, mountains and highlands have been discovered. Of extremely great interest for science were the voyages made by the oceanographic ships of the United States, Great Britain, France, Japan and Norway. The American ships investigated the Cromwell Current recently discovered in the Pacific Ocean; this current moves from west to east for several thousand kilometers and carries a quantity of water comparable to that carried by the Gulf Stream.

Although the processing and analysis of the principal data is still to be done, we may already assert that as a result of all these investigations our ideas about the world ocean have greatly changed. Until recently it was considered that the layer in which physical, chemical, thermodynamic and biological processes is intensively developed only extends to a depth of several hundred meters. Data collected during the IGY indicate that currents carrying water at a low velocity are encountered at depths exceeding 2-3 thousand meters. It is therefore clear that the disposal of the wastes of radioactive production must not be made in the depths of the ocean. It has become clear that the bottoms of the oceans possess a deeply incised relief with numerous submarine mountain ranges. On the ocean floor investigators have discovered considerable deposits of nickel, manganese, cobalt and copper. Their commercial exploitation is a prospect of the not too distant future.

Seismological research undertaken in connection with the IGY was on a very extensive scale. During this time primary attention was devoted to those regions where there had previously been very few seismic stations -- the Arctic and Antarctic.

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Many interesting data resulted from the IGY research program on variations in latitude and the movement of the poles, the acceleration of the force of gravity, and measurements made for the purpose of more precisely determining the shape of our planet and the speed with which it rotates on its axis.

In the Arctic and Antarctic

Although our entire planet was subjected to close study during the IGY period, special efforts were naturally required in the least-known region, Antarctica. In general the geophysical processes taking place in the polar regions are of great importance because their influence on the climate and weather of the Earth are very great. Also situated here are the geographic and magnetic poles; magnetic storms, ionospheric perturbations and polar auroras occur in the polar regions with special intensity.

Antarctica has offered a field for the widest sort of activity on the part of representatives of many sciences. It has been necessary to eliminate the white spot on the map. Names have appeared on the map such as Sovetskoye Plateau, the Russkiye Mountains, the "Pravda" Coast, the G. A. Gamburtsev and B. B. Golitsyn (subglacial) Mountains, and the O. Yu. Shmidt Plain. Extending for three thousand kilometers around the coasts of Antarctica there is a deep-water depression which has been investigated by the researchers of the Soviet expedition and which has been given the name of the outstanding Russian navigator M. P. Lazarev.

The participants on the Soviet crossing from the station Mirnyy to the South Pole, the British-New Zealand polar specialists, who first crossed the continent, and the American polar workers who organized major sledge-tractor trains, visited completely unexplored places and collected much valuable data about the meteorological characteristics and glacial structure of regions situated in the deep interior of the Antarctic continent.

The efforts of our polar specialists resulted in the mapping of one-third of the entire coastline of Antarctica and the determination of the elevation of a considerable part of this ice-locked part of the Earth. It has been established that the peripheral part of Antarctica is not a continuous continent but an archipelago of islands covered by a single ice cap.

It has been necessary to carry on scientific work in this ice-locked continent during the polar night, during eighty-degree below zero weather, when there have been winds far exceeding 100 km per hour, in an atmosphere impoverished in oxygen, and under low atmospheric pressure. All these things demanded from the polar worker a tremendous amount of endurance and occasional heroism.

The Arctic was still another important region for work. Geophysical phenomena were studied there by about 50 scientific stations operated by various countries. Among them should be mentioned the Soviet drift stations SP-6, SP-7, and SP-8.

The researchers on these drift stations have collected valuable material on the climate of this uninhabited region, about the manner in which ice drifts, about sea currents and geomagnetic phenomena. They have

investigated the submarine Lomonosov Range which crosses the polar basin, and the Mendeleyev Range which runs parallel to it from Wrangel Island to Ellesmere Island; they have also determined the principal /outlines/ of other important submarine /features/.

We may look forward to interesting scientific conclusions from a comparison of the results of the operations of our SP stations and the data collected by the American stations "Alpha" and "Beta" which drifted in the Arctic Ocean during the period of the IGY.

Thirty Months of Steadfast Work

Behind us are 30 months of long overland crossings and expeditionary voyages, numerous measurements and countless observations. "Shining forever on the pages of history will be the names of those participants in the IGY who, at the cost of hard work and sometimes their very lives, made these new discoveries possible", — so wrote Academician I. P. Bardin, Chairman of the Soviet IGY Committee.

The principal treasure resulting from the conduct of the IGY is made up of countless graphs and tape recordings and miles of film that record the "pulse of the planet". There is no precedent for the collection of such a great volume of data that in so many ways indicates the physical processes of the Earth and is making it possible to discover its laws.

Now the data from the observations conducted in all countries /are/ being concentrated in the World Data Collection Centers. One of the two great centers is situated in the United States and the other is in our country. Soviet scientists for the first time are able to use data collected on a worldwide basis. They will use this data for comparative analysis, without geophysics cannot now exist as a science.

As a result of the IGY the science of geophysics has taken a great stride forward. There has also been a considerable expansion and upgrading of the network of scientific institutions. Measures are now being taken in all advanced countries to insure that there is no letdown in the level of observations. The majority of the geophysical stations are continuing their work and coordinated research in the Antarctic is being continued.

It is generally accepted that the method for conducting observations on a worldwide basis has completely proven itself. But all the efforts made in the IGY period will bear abundant fruit only after careful processing and an attentive comparison of the entire mass of factual data that have become available because of the IGY. Then a tremendous contribution will be made to science that is in keeping with the grandiose work expended in the period of observations. To do so it is necessary that we process all the data stored in the World Data Collection Centers, subject them to the most careful analysis and publish hundreds of articles and dozens of monographs. In this connection all the country-participants in the IGY program in the years immediately following the end of the period of observations are undertaking a major period of processing, /analysis/ and publication of IGY data.

Besides enriching humanity with new knowledge about its native planet, the IGY also had another result whose importance cannot be overestimated. During the IGY period harmonious scientific relationships were established among the geophysicists of the entire world. This often took the form of joint conduct of expeditions. Thus, German scientists worked with our scientists on the Fedchenko Glacier and aboard the oceanographic vessel "Lomonosov"; Polish scientists conducted research in Vietnam and on Spitsbergen; a Czechoslovak specialist took part in a Soviet Antarctic Expedition; finally, two American meteorologists conducted observations at Mirnyy and two of their Soviet colleagues spent the winter at the Little America station --- as a result they have already jointly written books. There was an extensive mutual assistance on the part of skilled personnel and interchange of equipment. Cases became known to the entire world when the representatives of one country immediately extended the hand of assistance /to/ scientists of another country as soon as an alarm was given.

In the course of this friendly and businesslike intercourse the authority and prestige of Soviet science was noticeably strengthened. During the course of the Moscow Assembly of the Special (International) Committee for the Conduct of the IGY foreign scientists were in agreement with the opinion of Soviet geophysicists on the very important problem of prolonging the period of observations by one year. Many proposals by our scientists on major problems were also adopted at other international meetings and conferences. The first vice-president of the Special (International) Committee of the IGY was V. V. Belousov, Corresponding Member of the Academy of Sciences of the USSR; he was later elected President of the International Committee responsible for the conduct of the IGY. The coordination of the activity of the geophysicists of the countries of people's democracy was accomplished on the authority of international organizations by the Deputy Chairman of the Soviet Committee of the IGY, Yu. D. Bulanzhe, Doctor of Physical-Mathematical Sciences. All this was evidence that the leading role of Soviet science had become a generally recognized fact.

The International Geophysical Year is a shining example of active and effective cooperation among scholars representing countries with a different political structure. The agreement adopted in a conference in Washington providing for the peaceful utilization of Antarctica has reinforced this cooperation and it is only to be wished that its basic principles could be applied to the entire world.

The International Geophysical Year is entering into history as the beginning of major internationally coordinated research in the field of geophysics and as a year of remarkable successes in the science of the life of our planet and the mastery of the forces of nature by Man. ("By the Efforts of the Scientists of Sixty-Five Countries", by B. I. Silkin, Priroda, No. 4, 1960, pp. 35-42)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Latest Report from the Spaceship

The following is the major part of a dispatch published in Pravda on 2 July 1960:

At 1800 hours Moscow time on 1 July the spaceship completed its 731st revolution around the Earth; the last stage of the rocket-carrier has completed 756 revolutions.

The airtight cabin, moving in an orbit close to that of the spaceship, is lagging behind it by approximately 29 minutes. ("Movement of the Cosmic Spaceship", Pravda, 2 July 1960, p. 4)

Report on the June 1960 Firing of a Ballistic Rocket

The following is the full text of a report appearing recently in the Soviet press:

In the Soviet Union research is continuing for the study of the upper layers of the atmosphere and of cosmic space by means of geophysical rockets.

In accordance with the research program there was another launching of a single-stage ballistic rocket in June 1960. Scientific research apparatus was lifted into the upper layers of the atmosphere; its total weight including the power sources and the animals making the flight (two dogs and a rabbit) was 2,100 kg.

The rocket carried ... struments for the formation of ionized clouds in the upper layers of the atmosphere and for their investigation, for making measurements of the intensity of the electrical field on the rocket's surface, for studying the structure of the ionosphere, for photographing cloud systems over an extensive territory, for investigation of the Earth's infrared radiation and that of its atmosphere and for study of the ultraviolet radiation of the Sun; there were also instruments for determination of the composition of the atmosphere and its meteorological parameters at great altitudes.

The launching of the rocket went off successfully. The rocket attained its prescribed altitude — 208 km.

The scientific apparatus carried by the rocket functioned normally. The research program was completely accomplished. Valuable scientific data were received relative to the observation of the ionized clouds formed at great altitudes, the ion composition of the atmosphere and its electrical properties, the radiation of the Earth and Sun, and new data on muscle tone of animals under conditions of weightlessness. The condition of the animals after return to Earth is good. The dog "Otvazhnaya" has now completed her fifth journey into space.

The measurements and observations made on the flight are now being analyzed. ("Still Another Rocket-Researcher!", Izvestiya, 5 July 1960 (Evening Edition), p. 1)

Further Report on the Launching of the June Ballistic Rocket

The following is the full translation of a feature article in Izvestiya:

Our correspondent has approached B. A. Mirtov, Senior Scientific Worker at the Institute of Applied Geophysics of the Academy of Sciences of the USSR, with a request that he tell the readers of Izvestiya about the most recent launching of a ballistic rocket.

Here is what he said:

"Such launchings have been conducted over a period of many years for the investigation of the upper layers of the atmosphere. The rocket lifts a large payload. The researchers can therefore equip it with all kinds of scientific apparatus; this makes it possible to solve complex and serious geophysical problems."

"The rocket launched in June, as already mentioned in the TASS report (translated above), carried apparatus that was situated not only in the rocket itself but also in a separable container. The rocket, on entering the rarefied upper layers of the atmosphere, contaminates it with gases which are given off by the motor. The separable container makes it possible to conduct research of the 'unperturbed' layers of the atmosphere. This constitutes the great superiority of our research in comparison with that research which is conducted abroad. This is due to the small power of the rockets used abroad for this sort of research."

"It is of extraordinary importance that the container holding complex and delicate equipment reaches earth by parachute in good condition. Scientists have thereby received extremely important data which it is impossible to radio to earth during the course of the flight."

"The instruments carried in the rocket and in its containers have determined the electron concentration (the number of electrons in one cubic centimeter) as well as the chemical composition of the investigated layer. However the natural ionosphere is often unstable, especially in the high latitudes. This leads to a disruption of communications. Researchers have therefore tried to create an artificial ionized cloud which can be used for the transmission of radio signals at the time and distance needed by researchers in order to compensate for the capricious behavior of the natural ionosphere."

"Such clouds were created by means of special instruments at the time of the flight of the rocket."

"Photographs were made of ordinary clouds and cloud systems in the Earth's atmosphere from a great altitude. The resulting series of photographs will help scientists and forecasters to get a clear idea of the weather-forming processes over a great territory. Without doubt in the future this will make weather prediction an easier matter."

"In addition to the investigations mentioned, a great deal of attention was devoted to the study of the density of the high layers of the atmosphere, the investigation of the Sun's spectrum in the ultraviolet region, and the infrared radiation of the Earth."

"The study of the infrared radiation of the Earth helps us to make more precise our knowledge of the heat balance of the Earth as a planet."

"In addition to the investigation of the physical properties of the upper atmosphere research was conducted inside the rocket on the behavior of the living organism under flight conditions. It has been established that the condition of the animals is excellent. It is very important that the experimentation with animals and their rescue has in every case ended successfully."

"Despite the fact that investigations of the atmosphere have been made repeatedly by the use of rockets and satellites, the Earth's ocean of air remains but little explored. Indeed the Earth's atmosphere (and especially its upper layers) /is/ subject to severe changes in time and space. In order to investigate the diurnal, seasonal, annual and other variations in changes of the various physical properties it is therefore necessary to repeat such experiments again and again by the means of rockets and satellites and by means of other 'indirect' research procedures." ("In the Upper Layers of the Atmosphere," Izvestiya, 5 July 1960 (Evening Edition), p. 1)

Summary of a Soviet Report on the Space Traveller "Otvazhnaya"

Two dogs — "Otvazhnaya" and "Malek" — were aboard the single-stage ballistic missile launched in June. A third passenger, a small rabbit named "Zvezdochka" was also carried on the flight.

After her fourth flight "Otvazhnaya" rested for two months. During this time she was given a special diet; she was again subjected to all kinds of training: in a centrifuge in which researchers artificially created conditions existing in outer space, in a vibrating apparatus where she was subject to vibrations such as she would experience aboard the rocket, etc. Another dog, "Malek," was selected to make his initial flight. The animals wore space suits and were taught to remain in a fixed position in a cradle. They were enclosed in a compartment for two hours while instruments recorded their physiological functions, blood pressure, heart muscle behavior and breathing. A movie camera took pictures of their behavior.

During her training "Otvazhnaya" behaved very calmly because of her previous experiences. "Malek" was alarmed at first and tried to free himself from the suit but he also calmed down quite soon.

The parachute system of the rocket operated very well. The researchers arrived aboard two helicopters at the point where the nose cone landed. Investigation of the instruments and passengers showed that the launching and landing had been an unqualified success. Subsequent examination showed that the animals had suffered no significant aftereffects. ("'Otvazhnaya' Feels Fine," V. Reut, Pravda, 6 July 1960, p. 6)

Academician Blagonravov Comments on the Flight of the Ballistic Missile

A brief article in Pravda by Academician Blagonravov contains little not reported in other articles quoted above. He is quoted in part below:

"Our geophysical rockets are designed in such a way that the scientific apparatus and instruments are separated from it during the course of the flight for the purpose of eliminating the influence of perturbations arising in the atmosphere as a result of the flight of the rocket itself. The size of the payload lifted by the rocket makes it possible to make careful biological research, a preliminary step in preparing for flight by a man. In recent experiments we have received new data in respect to muscle tone under conditions of weightlessness."

"(The flight has) demonstrated the high reliability of the rescue equipment...since all the animals and instruments were returned to Earth in good condition." ("The Journey of 'Otvazhnaya'," by A. A. Blagonravov, Pravda, 5 July 1960, p. 4)

Izvestiya Reports the Launching of a Powerful Rocket

"As (earlier) reported, in the period between 5 July and 31 July 1960 the Soviet Union will test new varieties of powerful multi-stage rocket-carriers for space research."

"In accordance with the plan one of these rockets was launched on 5 July. The launching of the rocket occurred at a precisely designated time. The flight of the rocket took place in strict accordance with the projected program."

"The dummy of the last stage of the rocket, adapted for passage through the dense layers of the atmosphere, reached the surface of the water in the immediate vicinity of the intended point of fall; this was about 13,000 km from the launching point. Special ships situated in the central part of the Pacific Ocean, equipped with various kinds of measuring apparatus, performed all the prescribed measurements in the program and valuable results were derived."

"For the purpose of continuing the accumulation of experimental data tests of powerful ballistic rockets will be continued. The rockets will fall within the boundaries of the zone announced in a TASS report of 29 June."

("Directly to the Intended Target -- the Successful Launching of a Powerful Soviet Rocket," Izvestiya, 6 July 1960 (Evening Edition), p. 1)

Pokrovskiy Comments on the Launching of the Newest Soviet Rocket

The following is the full text of an article by G. Pokrovskiy, Doctor of Technical Sciences:

The launching of a powerful multi-stage rocket on 5 July 1960 is evidence of a new stride made by the Soviet Union on the way to the study and mastery of space for the welfare of humanity. The fact that the region designated for the proposed falling of the new /types/ of rocket-carriers was decreased by 2 1/2 times in comparison with the area designated in preceding tests in evidence of the considerable progress of Soviet rocket technology. The glorious success of the last launching has confirmed this.

The next to the last stage of the cosmic giant, travelling a distance of 15,000 km (measured on the Earth's surface) went precisely to the designated place in the Pacific Ocean. It is also significant that the launching and the arrival at the designated point on the globe took place at precisely the specified moments of time. This means that the automatic devices controlling the flight of the rocket act precisely and faultlessly.

After comparing these results with the recent experiment of lifting two dogs and a rabbit into space and safely returning them to Earth, we see that the Soviet Union is rapidly approaching not only the realization of cosmic travel, but also the utilization of rockets for intercontinental flights by man. In the future powerful rockets can be included in the world's transportation system for the delivery of passengers and valuable loads within a period of several dozen minutes from anyone point on the globe to any other point on the planet.

Such a flight will take no more time /than/ a trip on the trolley or bus within the limits of a large city.

For example, it will be possible to make a flight from Riga to Santiago (the capital of Chile in South America) or from Tiflis to the shores of Antarctica in the length of time expended by the residents of Moscow in travelling, for example, from the Khimkin river station to the university area.

The unlimited possibilities of human genius and what seems today to be a distant dream will tomorrow become reality. There is no doubt that the successfully begun tests of the new varieties of rocket carriers will make it possible to accumulate extremely valuable experimental data that will permit us to proceed to the next stage of mastery of cosmic space — the reaching of the nearest planets. ("Forerunner of Trips to Planets," by G. Pokrovskiy, Izvestiya, 6 July 1960 (Evening Edition), p. 1)

III. UPPER ATMOSPHERE

New Map of Moon Published in USSR — News Item Published in "Pravda"

Tashkent. 4 July. ("Pravda" correspondent). The Uzbek Branch of the All-Union Astrogeodetic Society has published a new lunar map. In contrast to already published maps it contains the names of all the portrayed features. This lunar map, printed in three colors, graphically indicates the Moon's seas, mountain ranges, craters and the other surface features. A symbol indicates the point where "Lunnik-2" fell, delivering to the Moon's surface a pennant bearing the coat of arms of the Soviet Union.

On this same map sheet, but at a smaller scale, there is a map of the part of the Moon's surface that is invisible from the Earth but which was photographed by the automatic interplanetary station on 7 October 1959. It shows new surface features on the Moon — the Sovetskiy Range, the Mechta Sea, Moscow Sea and the craters named for Lomonosov, Tsiolkovskiy, Jules Verne, Mendeleyev, Kurchatov and others.

In the near future this same lunar map will be published in the Uzbek language as well. ("New Map of the Moon," Pravda, 5 July 1960, p. 4)

Photo in Soviet Press Shows Radiointerferometer at Station Near El'brus

The following is the text of a photo caption appearing in a recent issue of Sovetskaya Latviya:

Stavropol Kray: A High-Mountain Astronomical Station of the Academy of Sciences of the USSR is situated not far from El'brus. There, at an elevation of 2,130 m above sea level researchers are making observations of the Sun's corona, sun spots, prominences, flocculi and other forms of solar activity, including the recording of the radioradiation of the Sun. The scientific material collected by the station is for use in the solution of a number of problems of importance to the national economy. The photo shows the radiointerferometer of the mountain astronomical station. (Untitled photograph, Sovetskaya Latviya, 19 May 1960, p. 4)

A New Method for Determining the Earth's Albedo

An article appearing in the journal Priroda, written by two workers at the Astrophysical Institute of the Kazakh Academy of Sciences at Alma-Ata, reviews the problems associated with the determination of the Earth's albedo and briefly describes a new method used at the Institute for this purpose.

The article begins with an explanation of the importance of the albedo, it then describes the concept of the spherical albedo, and proceeds with a description of the methods used for the determination of the albedo. It describes the difficulty of determining the Earth's albedo and stresses the importance of the ashen color of the Moon as our /principal/ aid in making such a determination. The article briefly describes the application of photometry to this problem.

The article points out that only eight determinations have been made of the Earth's albedo and that all are different, with a mean value of 0.42. But, the authors continue, these different values may be the result of actual changes in this value with the passage of time. It is known, for example, that the percentage of the Earth's surface covered with clouds can vary from year to year, in particular in relation to the 11-year cycle of solar activity. At different periods the dust content of the atmosphere may increase sharply as the result of such phenomena as major volcanic eruptions or forest fires.

V. G. Fesenkov of the Astrophysical Institute of the Kazakh Academy of Sciences proposed that the Earth's albedo be redetermined; this work was accomplished by staff members E. K. Dzhasybekova, Z. V. Karyagina, V. M. Kazachevskiy and A. V. Kharitonov. To determine the albedo they used the method developed by V. M. Kazachevskiy in 1953. This method is described in one paragraph.

As a result of almost two years of observation (1957-1959) the mean value of the albedo was determined to be 0.39. This value coincides well with those values received earlier. The accuracy of these observations is nevertheless inadequate for a reliable clarification of seasonal variations in the Earth's albedo and its possible changes with change in activity on the Sun.

It would be possible to increase the accuracy of the determination of the Earth's albedo if we compared the brightness of the Moon's "sickle" and its ashen color by the methods of photoelectric photometry which are being rapidly perfected at the present time. Still greater promise is offered by the possibility of using artificial earth satellites for this purpose. ("The Earth's Reflecting Power," by V. V. Kazachevskiy and A. V. Kharitonov, Priroda, No. (unknown), 1960, pp. 95-96)

Soviet Physicists Lecture on High Energy Particles, Magnetic Storms, and Lunar Magnetism

Reporting on talks at the Moscow Polytechnic Museum by four Soviet physicists who won Lenin Prizes for studies on radiation belts around the Earth and on magnetic fields of the Earth and Moon, this dispatch includes the following information.

Sergei Vernov, corresponding member of the Academy of Sciences, USSR, said that the most probable cause for the origin of high energy particles must be sought in cosmic rays within the inner radiation belt. Vernov hypothesizes that a gigantic, as yet undiscovered, accelerator is functioning in the vicinity of the Earth.

Nikolai Pushkov, director of NIZMIR (Scientific Research Institute of Terrestrial Magnetism, the Ionosphere and Radiowave Propagation, Academy of Sciences, USSR), said that theories are being developed concerning the origin of magnetic storms, northern lights, and other phenomena.

S. Dolginov, also of the same institute, said that the Moon has no magnetic field, or, in any case, the magnetic field at the surface of the Moon is 400 times smaller than that at the surface of the Earth. ("The Moon Has No Magnetic Field" (unsigned, Czechoslovak news service /CTK/ from Moscow); Bratislava; Uj Szo, 26 May 60; p. 4)

IV. METEOROLOGY

Russians Construct Remarkable Tower for Investigation of the Lower Layers of the Atmosphere

"By the use of the most modern technical equipment Soviet scientists are conducting complex investigations of all layers of the atmosphere. This includes the lowermost layers of the atmosphere — those directly adjoining the Earth's surface. In these lowermost layers of the atmosphere there are

extraordinarily complex and important processes transpiring. These processes are of great importance for all life and the activity of man. In these layers there is a constant exchange of heat and moisture between the atmosphere and the soil."

"Quite recently scientists have been given a new and potent means of studying the lower layers of the atmosphere. An immense laboratory tower 313 meters high has been built in the vicinity of Moscow. This tower is a steel tube painted in a silver color. The tower is designed in such a way that it is exceptionally stable. Steel guy wires are used to support it and it will withstand winds of hurricane force."

"The tower contains an elevator which requires three minutes to take the rider up to the highest point; in this upper part of the tower there is a circular office where scientists are busy at work at their instruments."

"The tower was designed by the State Institute for the Design, Study and Testing of Fabricated Steel and Bridges; the tower itself was manufactured by the Babushkin metal works in Dnepropetrovsk."

"Many observations are made and interesting results have been obtained concerning phenomena in the lower layer of the atmosphere. The instruments used to record these phenomena are attached to long arms outside the tower so that measurements are made under natural conditions."

"It is no accident, of course, that the tower has been built near the world's first atomic electric station (AES); serious research is being conducted here in the atmosphere surrounding the AES-1. It has been established that the atomic electric station does not contaminate the atmosphere."

("Beyond the Clouds in an Elevator," by Ye. Ryabchikov, Pravda, 7 July 1960, p. 4)

Description of a Flight by the Soviet Substratostat "SSSR VR-100"

A brief article recently appearing in the Soviet press describes the flight of a Soviet "substratostat." Few details are given, but a photograph accompanies the article. The balloon rose into the air from the grounds belonging to the Central Aerological Observatory of the Main Administration of the Hydrometeorological Service. The substratostat travelled at an altitude of 10 to 11 kilometers where the temperature was 50 degrees below zero. Takeoff time was 0500 hours and it was expected that the flight would last for 4 or 5 hours. Within 50 minutes an altitude of 10,600 meters had been reached. At 0730 hours the substratostat passed over Lukhovitsa and at 1010 hours the substratostat landed safety in the vicinity of Zaraysk. (A photograph shows the members of the crew; another shows the "SSSR VR-100")
("Peaceful Flight", Vechernaya Moskva, 28 May 1960, p. 2)

"Sun-Troposphere" Conference Held in Leningrad

As interdepartmental conference on the "Sun-Troposphere" problem was held in Leningrad in February 1960. The conference was organized by the Solar Commission of the Academy of Sciences USSR with the support of the Main Administration of the Hydrometeorological Service USSR and the Main Geophysical Observatory imeni A. I. Voyeykov.

The conference was deemed necessary to analyze the present state and methods of investigation being used in the "Sun-Troposphere" problem. The conference was attended by 127 specialists from 25 scientific institutions. A total of 23 reports were presented by representatives of 16 of these institutions. ("Conference on the 'Sun-Troposphere' Problem," N. V. Kolobkov; Moscow, Meteorologiya i Gidrologiya, No 6, 1960, pp 51-52)

Conference on Regional Synoptics

A conference on ragional synoptics was held in November 1959 at the Tbilisi Scientific Research Hydrometeorological Institute. The conference was called by the Main Administration of the Hydrometeorological Service. Specialists from the Main Administration of the Hydrometeorological Service of the Trans-Caucasus republics, from the North-Caucasus, Ukrainian and Turkmen Main Administration of the Hydrometeorological Service, from the Ukrainian and Central Asiatic Scientific Research Hydrometeorological Institute, from the Uzbek and Georgian academies of science, and representatives of the Main Administration of the Hydrometeorological Service and the Central Institute of Forecasts were present at the conference in addition to associates of the Tbilisi Scientific Research Hydrometeorological Institute. ("Conference on Regional Synoptics," by Ye. A. Napetvaridze; Moscow, Meteorologiya i Gidrologiya, No 6, 1960, p. 54)

Soviet Ship in Black Sea Fires Research Rockets

The Soviet hydrometeorological ship Yu. M. Shokal'skiy, making its first trip in the Black Sea, is firing meteorological rockets to altitudes of 70 kilometers. The rockets relay to earth data on air temperature, air pressure changes, and solar radiation. The nose cone of the rocket separates and returns to earth by parachute, tracked from the ship by radar. ("New Soviet Meteorological Rockets Rise to Altitudes of 70 Kilometers" (unsigned, Czechoslovak news service /CTK/ from Moscow); Bratislava; Uj Szo, 19 Jun 60; p. 2)

V. OCEANOGRAPHY

"Izvestiya" Radio Reports from Additional Research Vessels

"Izvestiya" is continuing its series of radio reports from Soviet research vessels now at sea. Full texts are given below:

"Mikhail Lomonosov": It will soon be a month now that the "Mikhail Lomonosov", expeditionary vessel of the Marine Hydrophysical Institute of the Academy of Sciences of the USSR, has been conducting its extensive program of physical research in the waters of the North Atlantic.

The "Mikhail Lomonosov" is accomplishing its scientific work for the purpose of studying the physical processes taking place in the waters of the Atlantic Ocean and that part of the atmosphere near its surface. In particular it is studying the transfer of heat by the Gulf Stream and the extent to which its warm waters influence the climate and weather of Northern Europe.

In the 130 days that the expedition will be at sea the vessel will sail about 13,000 miles and will conduct observations at many points in the ocean.

The expedition has completed its work in the waters of the Sargasso Sea on whose surface there is a floating mass of yellowish Sargasso seaweed and is enroute to the Canadian port of St. John's where the world's highest tides — up to 18 meters — will be observed.

In the center of the Atlantic Ocean we twice met up with those tireless workers of the sea — the Soviet commercial fishing vessels of the Kaliningrad and Murmansk Sovnarkhoz Organizations; they are undertaking a search for fish in new regions. — V. Ivanov, Chief of the Atlantic Expedition.

"Persey-2": After completion of our expeditionary work we have arrived at the port of Westmannhavn. A reception of the leaders of the expedition and the captains of the ships was held aboard the lead ship "Explorer". The meeting was most cordial. The work of the expedition was acknowledged to be a remarkable phenomenon in the history of oceanographic science. There was collected a mass of material that is outstanding in volume and importance and which is needed for the solution of a series of important scientific problems.

After replenishing its fuel in the Scotch port of Lerwick the "Persey-2" set about the accomplishment of the second part of its program. Having received radioed data from the oceanographic survey of the Norwegian Sea and the Greenland Sea that had just been completed by the fish reconnaissance vessels of the Kaliningrad and Murmansk Sovnarkhoz Organizations, the scientific staff of the vessel made ready to participate in the special annual conference on herring. This meeting is taking place in the Icelandic port of Seydhisfjordhur. On the way to the shores of Iceland we conducted additional oceanographic work. — M. Adrov, Candidate in Geographical Sciences. ("Radio Reports from Science Ships," Izvestiya, 1 July 1960, p. 3)

Radio Report from the "A. I. Voyeykov"

The "A. I. Voyeykov," research vessel of the Hydrometeorological Service, has left Vladivostok on its fourth cruise. The ship is commanded by the young captain V. I. Khvorostenko.

The expedition staff for the most part is made up of workers from the Far Eastern Hydrometeorological Scientific Research Institute. Also participating are workers of the Central Aerological Observatory and the Institute of Oceanology of the Academy of Sciences of the USSR.

The ship's crew has dedicated this cruise to the 100th anniversary of the city of Vladivostok.

We will conduct investigations of the upper layers of the atmosphere and air currents above the ocean by the use of radiosondes and meteorological rockets. We will also study the waters of the ocean in different latitudes and at different depths.

The "A. I. Voyeykov" is simultaneously performing the functions of a weather ship. Before us there is a twenty-day drift at sea in a small area of the ocean. During this entire period there will be continual observations of the weather and the condition of the sea. Weather summaries will be transmitted from the ship and forecasts will be compiled. In addition we have a major program of oceanological observations in tropical and equatorial zones.

The laboratories of the "A. I. Voyeykov" are equipped with modern instruments and technical facilities. The ship is now crossing the Sea of Japan; scientific observations have begun. — G. Ivanov, Chief of Expedition. ("Radio Reports from Science Ships," Izvestiya, 6 July 1960 (Evening Edition), p. 3)

News of the Research Vessel "Okeanograf"

The expeditionary vessel "Okeanograf" is once again in the Gutuyevskiy harbor of the maritime port of Leningrad. It recently returned from sea and is now making ready for a new departure on a spring oceanographic survey.

The expedition will operate in the Gulf of Finland and in the northern part of the Baltic Sea. The objective of this voyage is the study of water temperature, salinity, chemical properties, currents and wave action. Meteorological observations will also be made in the open sea by means of the vessel's remote control hydrometeorological station. A series of such observations will clarify the extent to which temperature decreases as the vessel gets farther from shore. Wind observations will be made at sea and these will be compared with observational data from shore points.

After repairs the "Okeanograf" will be outfitted with several new instruments. One of the most important of these is a multi-action bathometer-bathythermograph. While collecting water samples this instrument will simultaneously determine its temperature and the depth at the point from which the sample has been taken. ("Into the Spring Sea," Leningradskaya Pravda, 19 May 1960, p. 4)

Hydrostat Augments Soviet Oceanographic Research Potential

The following is the full text of a Pravda report:

A /diving bell/ that can submerge to a depth of 600 meters has been constructed in Leningrad at the Baltiysk shipyards. It will be used for the study of submarine flora and fauna for the purpose of increasing the take of fish. The /diving bell/ makes it possible to observe the distribution and behavior of invertebrates, the character of the bottom, bottom relief and bottom vegetation. An observer seated in the /bell/ can observe the density configuration and mobility of shoals of fish and study their reaction to light, noise, movements of the trawls, nets, hooks, etc.

The successful termination of shipyard testing of the apparatus has shown that its design satisfies modern demands. The apparatus displaces 2,190 m^3, its weight with emergency equipment is 2,300 kg, it is 3,350 mm high and has a diameter of 1,250 mm. The apparatus for regeneration of air will operate for 6 hours.

The comparatively great depth to which the /bell/ will submerge (the presently existing Japanese /bell/ "Kurosiwo" submerges to 200 m and the Italian /bell/ "Galeazzi" submerges to 300 m) requires that it be given an unusual pear shape. It is lowered and raised by reeling out or in a steel cable on the drum of an ordinary trawler winch. There is a single cable to supply electric power and for communication by telephone.

At the eye-level of an observer seated on a rotating stool there are five small windows that provide a complete view. Above the entrance hatch there are a floodlight and a "flash bulb" which the observer can aim at any object by using a remote control drive. There is an apparatus for the ejection of emergency equipment when it is necessary for the /bell/ to surface independently. In order to find the /bell/ in the dark after it has surfaced there is a signal lamp within the housing of the "flash bulb" device: this will operate on batteries for a period of 24 hours.

When the apparatus makes an emergency surfacing the observer is able to get air directly from the atmosphere; for this purpose there is a ventilating device with valves on the upper surface of the /bell/ which prevent the penetration of water into the /bell/. To this same device it is possible to attach diving hoses to carry air. This may be necessary in case the /bell/ is stuck at a depth inaccessible to a diver. Two diverging branches of the cable safeguard the apparatus from turning and make it possible for the observer to orient himself in relation to the ship base.

The /bell/ is equipped with a photometer for measuring the horizontal illumination of the water, a Forel-Uhl scale for determination of the water color by comparison, a depth gage, a camera and a movie camera; the latter can be shifted to any window.

The /bell/ has an electromagnetic compass, a mechanism for turning the search light and "flash bulb", a telephone, lamps for ordinary and emergency lighting, a psychrometer and barometer.

The body of the /bell/ consists of two cylinders: an upper with an internal diameter of 1.1 meter and a height of 0.7 meter and a lower with an internal diameter of 0.8 m and a height of 0.8 meter. The ends are spherical. The cylinders are connected by a transitional cone in which the windows are located.

The windows, because of the cone, are inclined at an angle of 15° to the vertical; this makes it possible to examine the bottom at a close distance.

The shape of the /bell/, in combination with a rational distribution of weight (instruments, mechanisms and observer), makes it stable even when it surfaces independently without emergency ballast. The body is made of alloyed steel 16 mm thick.

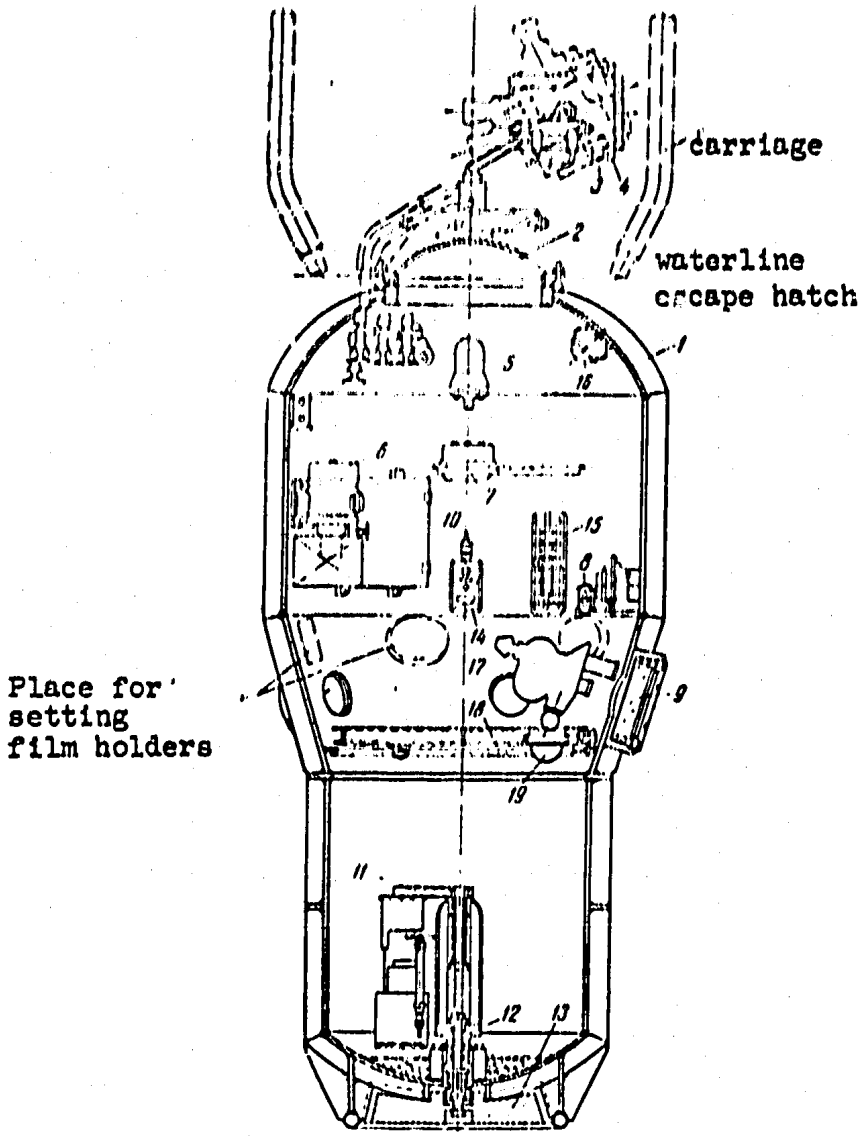
When designing the /apparatus/ a great deal of attention was devoted to the fashioning of a reliable entrance hatch and the windows. The entrance hatch was made rather ample; it is round and has a diameter of 0.45 m (in the Beebe bathysphere the diameter of the hatch is 0.35 m). The windows of the /bell/ are manufactured from organic glass 60 mm thick. The diameter of the windows is 0.14 m; this makes it possible to use both eyes when making observations.

In the searchlight and "flash bulb" the airtight steel containers have lenses made of stalinite 18 mm thick. The lighting of the "flash bulb" is synchronized with the opening of the camera's shutter. The searchlight has a power of 100,000 candle power.

There is an electrohydraulic drive for the turning and inclination of the searchlight and "flash bulb". The oil servomotors that rotate and incline the searchlight and "flash bulb" are situated outside the /bell/. In order to avoid the thickening of oil in the drive mechanisms of the servomotors the latter are connected by a hydrosystem operating by means of four flexible hoses. The /bell/ has two control posts (one facing the other, at the waist level of the seated observer).

The Polar Scientific Research Institute, the marine fishing industry and oceanographic science is receiving a remarkable new apparatus for making submarine ichthyological investigations.

("For the Study of Marine Flora and Fauna," by M. N. Diomidov (State Institute for the Design and Planning of the Fishery Fleet), Priroda, No. 4, 1960, pp. 93-94)



Hydrostat layout: (1) welded hull with external ribs for rigidity; (2) entry hatch; (3) revolving searchlight; (4) flash lamp; (5) device for holding cable; (6) electric oil pump for the revolving searchlight and flash lamp hydraulic system; (7) compass transducer; (8) compass dial; (9) porthole; (10) electrical distributing board; (11) revolving chair; (12) device for jettisoning emergency ballast; (13) emergency ballast (cast iron plate); (14) photometer; (15) Forel-Uhl scale; (16) lamp; (17) motion picture apparatus; (18) camera ring mount; and (19) movable camera mount

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